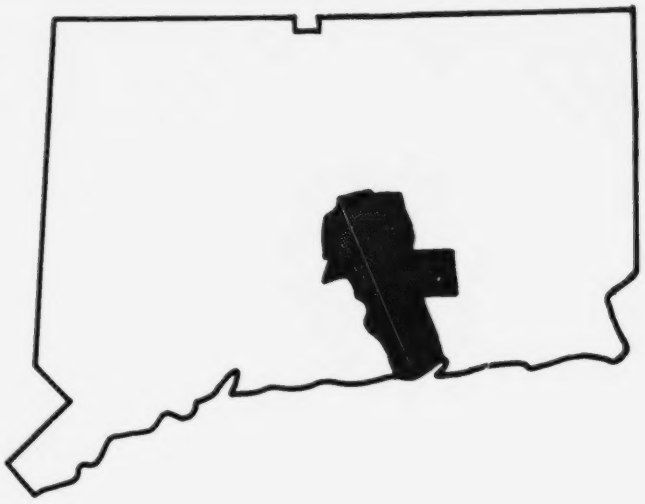
594-C-07 FEMI.209:090070

ORIGINAL

FLOOD INSURANCE STUDY

COMPLETED 42

TOWN OF WESTBROOK, CONNECTICUT
MIDDLESEX COUNTY



JUNE 1, 1982

Federal Emergency Management Agency

COMMUNITY NUMBER - 090070

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Exhibit 3 - Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index

Flood Insurance Rate Map

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1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Flood Insurance Study is to investigate the existence and severity of flood hazards in the Town of Westbrook, Middlesex County, Connecticut, and to aid in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to convert Westbrook to the regular program of flood insurance by the Federal Emergency Management Agency (FEMA). Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain development.

1.2 Coordination

Streams requiring detailed study were selected in a meeting attended by representatives of the FEMA, CE Maguire, Inc. (the study contractor), and the Town of Westbrook, on June 7, 1977.

The Soil Conservation Service (SCS), the Connecticut Department of Environmental Protection, the Connecticut Department of Transportation, the U. S. Geological Survey (USGS), The New England Division, U. S. Army Corps of Engineers (COE), the Connecticut River Estuary Regional Planning Agency, the American Red Cross, the Connecticut Water Company, and the Westbrook Historical Society were contacted for various types of information.

During the course of the work by the study contractor, specific information on peak discharge-frequency relationships, flood control channel and dam improvements, previous flood hazard evaluations, recent and impending flood plain development and the extent of historical flooding were obtained, reviewed and discussed with various community and state officials, and local residents.

On May 24, 1979, the draft of this report and associated maps were reviewed at a final coordination meeting attended by personnel from the FEMA, Westbrook, and the study contractor.

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1.3 Authority and Acknowledgements

The source of authority for this Flood Insurance Study is the National Flood Insurance Act of 1968, as amended.

Hydrologic and hydraulic analyses were prepared by CE Maguire, Inc., for the Federal Emergency Management Agency, under Contract No. H-4560. This work, which was completed in November 1978, covered all significant flooding sources in the Town of Westbrook.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Westbrook, Middlesex County, Connecticut. The area of study is shown on the Vicinity Map (Figure 1).

The coastal areas of Westbrook affected by tidal flooding from Long Island Sound were studied by detailed methods. The Patchogue River was studied from Boston Post Road (U. S. Route 1) to the Connecticut Turnpike (Interstate Route 95) by detailed methods. The Menunketesuck River was studied from Boston Post Road (U. S. Route 1) to the Westbrook-Clinton corporate limits by detailed methods. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction for the next five years, through November 1983.

Flooding along Dee, Johnson, McVeagh, Messerschmidt, Rintoul, Vincent, and Wrights Ponds; Boones, Plane and Trout Brooks; Mine Swamp, the Falls River, and the upper portion of the Patchogue River was studied by approximate methods. Approximate methods of analysis were used to study those areas having low development potential and minimal flood hazards as identified at the initiation of the study. The scope and methods of study were proposed to and agreed upon by the FEMA.

2.2 Community Description

The Town of Westbrook, a community of 16.2 square miles, is located in the southern portion of Middlesex County in south-central Connecticut along Long Island Sound. The town is bordered by Clinton on the west, Deep River and Essex on the north, Old Saybrook on the east, and Long Island Sound on the south.

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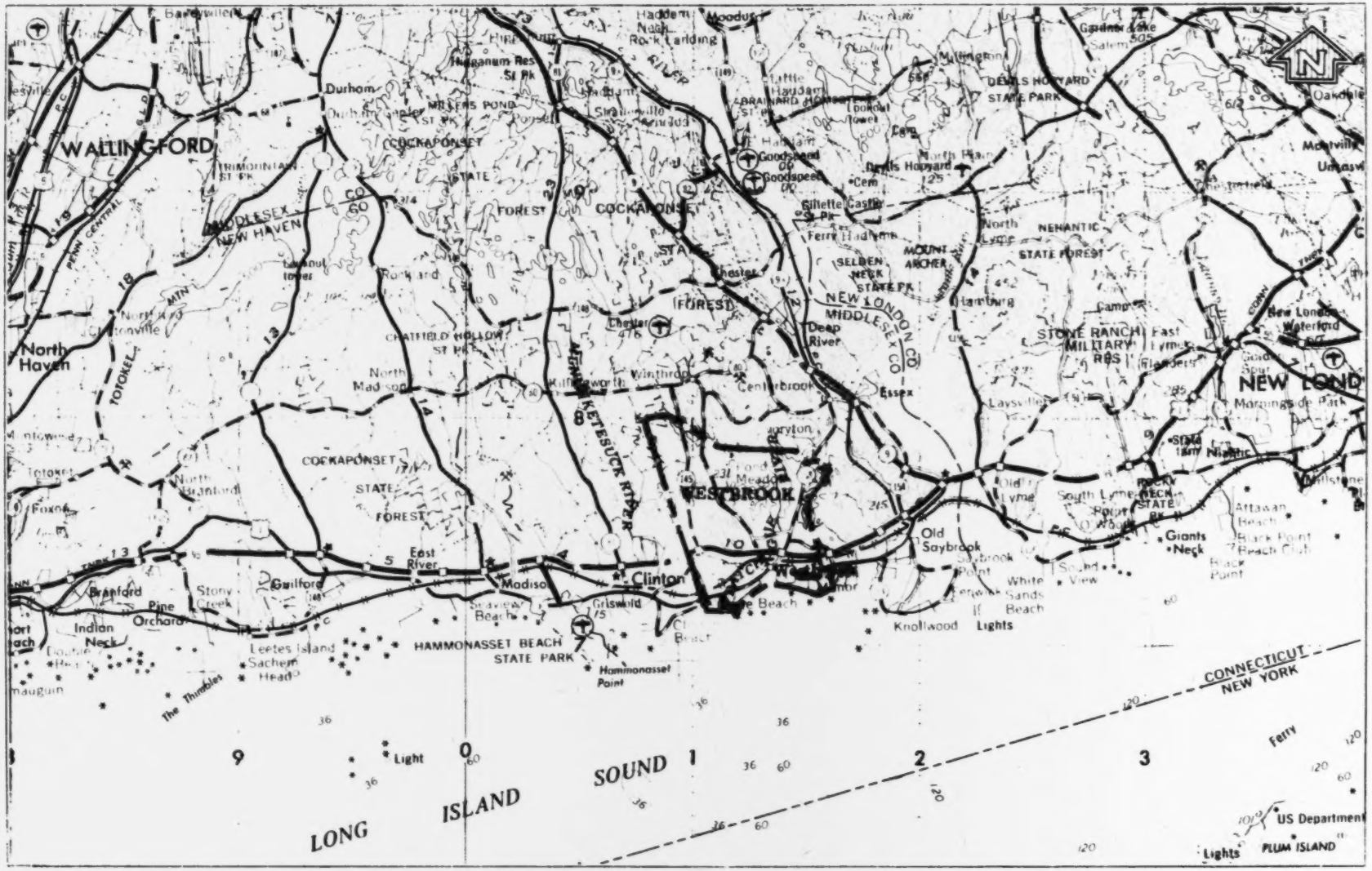

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

The 1976 population of Westbrook was approximately 4,800, giving a population density of 296 persons per square mile. During the decades of 1950-1960, and 1960-1970, the population of Westbrook increased by 55 percent and 59 percent, respectively (Reference 1).

The topography of the town features mainly flat lowland areas in the southern portion and rolling hills in the northern area. Elevations range from sea level along the coastline to 250 to 310 feet in many of the hills located in the northwest corner of the town.

The predominant soil type along the Patchogue River is swamp sediment consisting of undecomposed to partly decomposed organic matter mixed with sand, silt and clay.

In the areas where the river traverses Interstate Route 95, Boston Post Road and Conrail, deposits of artificial fill are evident. Along the west bank at different locations, glacial ground moraines and outwash sediments are encountered. The ground moraines consist of till, a nonsorted, nonstratified deposit of glacial debris ranging from clay-size particles to large boulders. The outwash sediments consist of sand and gravel deposited by glacial meltwater streams. On the east bank at various scattered points, the river passes through deposits of end moraine, a soil deposit consisting of till and stratified drift. The stratified drift consists of sand and gravel in varying amounts with occasional concentrations of boulders.

The soil in the area of the Menunketesuck River is primarily classified as swamp sediment. Areas of artificial fill are encountered where the river crosses Conrail and the Boston Post Road.

In the vicinity of the Clinton-Westbrook Town line, a few deposits of ice-contact stratified drift are evident. The ice-contact drift consists of poorly sorted sand, gravel, silt, and clay deposited by the melting glacier ice. Also evident in this vicinity is a deposit of till. Just east of this area is an area of bedrock exposure. The bedrock varies from completely exposed to thinly covered by till or rock slide. In the vicinity of the Boston Post Road, small areas of end moraine and outwash sediment are evident on the west bank.

Development within the flood plains studied consists generally of sparce residential with some light commercial development along the downstream reaches adjacent to Boston Post Road. Tidal wetlands comprise a large portion of the flood plains studied.

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The two major soil types along the Long Island Sound are beach sand and gravel and artificial fill. In the vicinity of Money Point there is an intrusion of till.

The climate of the region is characterized by moderately warm summers with temperatures averaging 70.1 degrees Fahrenheit ([F). The winters are cool with temperatures averaging 32.4[F (Reference 2). Measurable precipitation is uniformly distributed throughout the year and amounts to approximately 49.8 inches annually (Reference 2).

The community of Westbrook has been growing steadily over the past several decades and will continue to grow. As the population has increased, residential development has spread northward from the shore, from Boston Post Road to Interstate Route 95. Economic activity is largely confined to the southern portion of town along the Boston Post Road. Only sparse development has occurred north of Interstate Route 95, leaving that area predominantly rural in nature. Approximately 71 percent of the town's land is in rural or natural resource areas (Reference 3). Natural resource areas are ecologically sensitive areas, such as wetlands, steep slopes, aquifers, etc., that are limited to human uses that will retain the natural environment (farming, gardening, orchards, kennels, private camps). The Cockaponset State Forest in the northwest corner of the Town of Westbrook is a natural resource area. Industrial development is limited due to the town's orientation toward fishing and recreational activities.

2.3 Principal Flood Problems

All areas adjacent to streams in Westbrook are subject to flooding. The Westbrook coastline is subject to tidal flooding by coastal storms pushed northward by air currents.

The greatest floods of record were caused by heavy rainfall and hurricane winds of tropical origin, resulting in heavy runoff and abnormally high tides. The hurricane of September 1938 was the largest flood recorded in the study area. During this storm, the floodwaters of the Menunketesuck River overtopped the State Route 145 highway bridge by 8 to 10 inches (Reference 4). The highest tidal level (9.4 feet) along the Westbrook coastline occurred during the September 1938 hurricane (Reference 5).

During January 1978, a winter rainstorm caused severe flooding along the watercourses in the Town of Westbrook. Due to a combination of frozen ground, snowmelt, high tides, and increased development along

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all the watercourses in the town, this flooding was extensive and forced many families to evacuate their homes. Figures 2 through 6 show expected flood levels on the Menunketesuck and Patchogue Rivers in the town.

2.4 Flood Protection Measures

In 1973, the Town of Westbrook formed an Inland Wetland Watercourse Commission authorized by the Board of Selectmen in accordance with the provisions of the Inland Wetland and Watercourses Act of the Connecticut General Statutes. The Commission's primary function is to protect the public's interests by the preservation and protection of the wetlands and watercourses within the town from random, undesirable and unregulated uses, disturbance or destruction.

In 1972, the town formed a Harbor Commission to regulate and control coastal development along the Westbrook coastline with full regard for the protection and preservation of the natural resources of the town.

From field investigations and conversations with various town officials, it is estimated that approximately 70 percent of the Westbrook coastline has some type of seawall protection, the majority of which is privately owned.

There are no flood protection measures, existing or planned, along the Patchogue and Menunketesuck Rivers.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Floods having recurrence intervals of 10, 50, 100, and 500 years have been selected as having special significance for flood plain management and for flood insurance premium rates. The analyses reported here reflect current conditions in the watersheds of the flooding sources.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for floods of the selected recurrence intervals for each flooding source studied in detail in the community.

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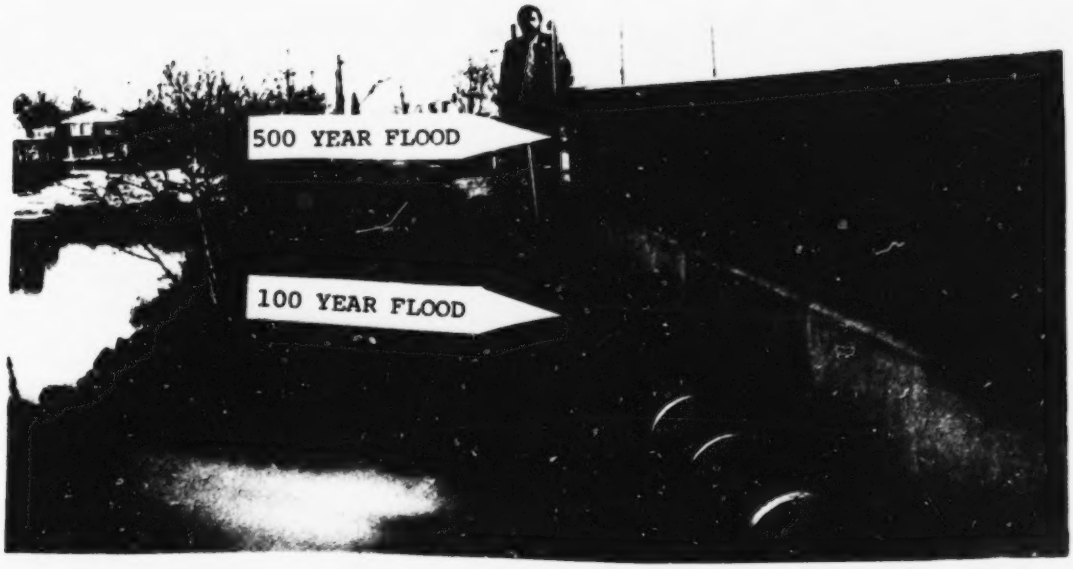

Figure 2 - Menunketesuck River, expected 100- and 500-year flood levels on U.S. Route 1 (Boston Post Road) - looking east.

Figure 3 - Menunketesuck River, expected 100- and 500-year flood levels on State Route 145 (Old Clinton Road) - looking north.

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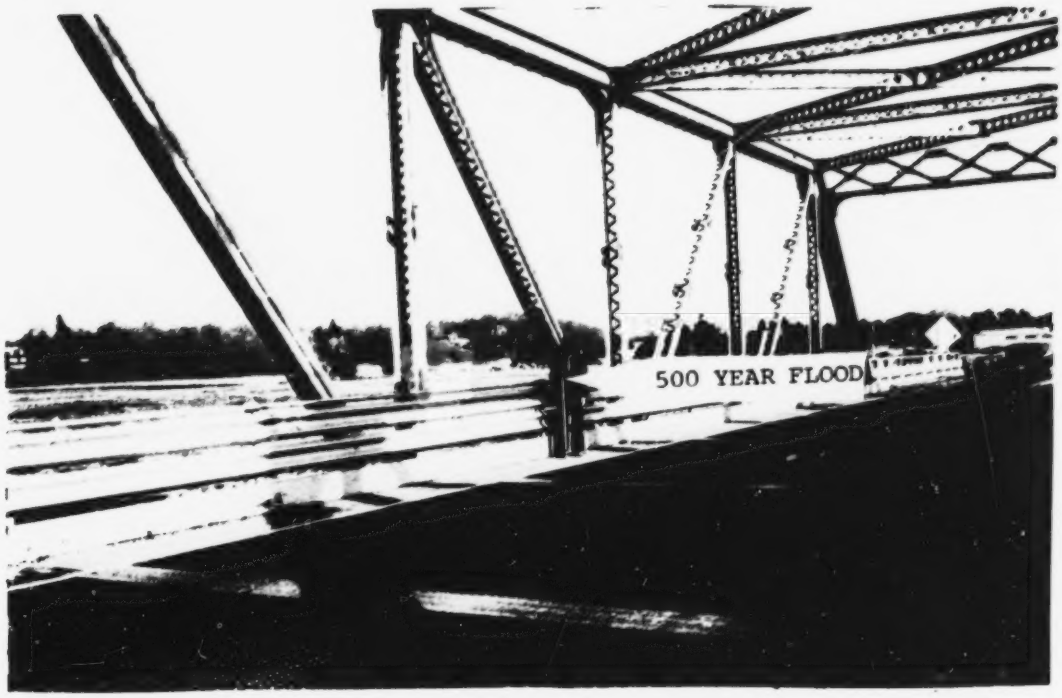

Figure 4 - Patchogue River, expected 500-year flood level on U.S. Route 1 (Boston Post Road) - looking northeast.

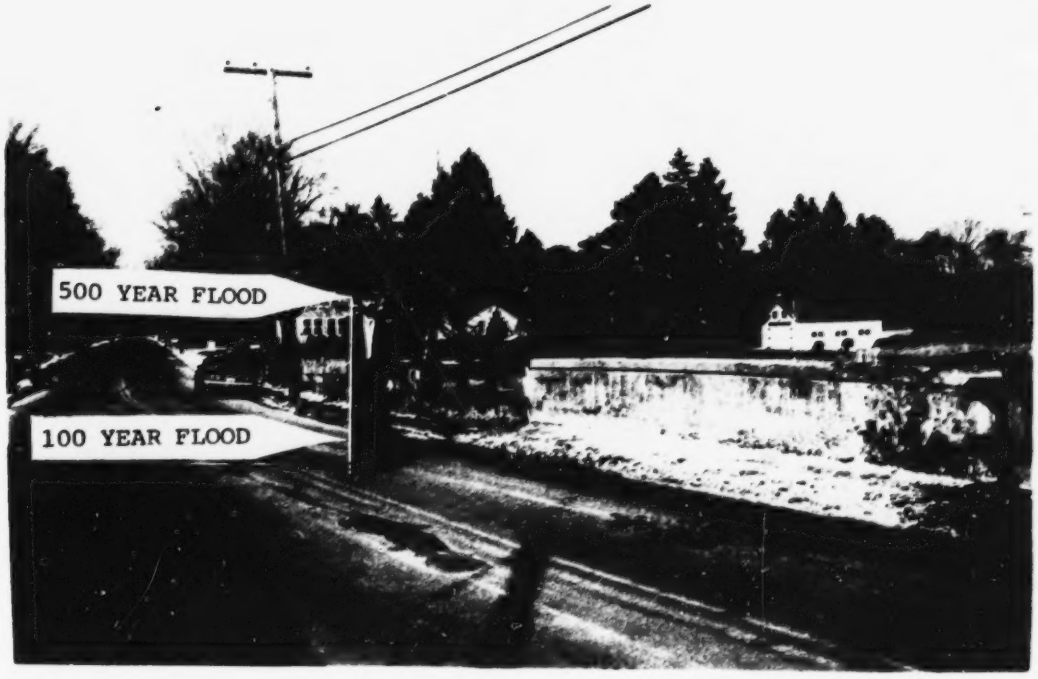

Figure 5 - Patchogue River, expected 100- and 500-year flood levels on Wesley Avenue - looking north.

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Figure 6 - Patchogue River, expected 100- and 500-year levels on Old Clinton Road - looking northeast.

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The Regional Frequency Method was used for computing peak discharges (Reference 6). Due to the inherent possibility of a large standard error in the Regional Frequency Method, a comparison of computations of discharges was done. A rainfall-runoff technique based on a synthetic triangular unit hydrograph and a SCS methodology were utilized to assist in the judicious adoption of discharges for various frequencies in a smooth curve (References 7 and 8).

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges." Tidal elevations for 10-, 50-, 100-, and 500-year frequency floods along the Town of Westbrook coastline were developed from information contained in COE Interim Memo No. 2 and are shown in Figure 7 and in Table 2, "Summary of Elevations" (Reference 5).

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
PATCHOGUE RIVER					
At Boston Post Road	7.53	540	920	1,100	1,600
At Interstate Route 95	6.52	486	827	989	1,439
MENUNKETESUCK RIVER					
At Boston Post Road	17.39	1,276	1,868	2,123	2,842
Just downstream of confluence with Gatchen Creek	16.74	1,244	1,820	2,069	2,770
At Old Clinton Road	15.22	1,166	1,706	1,940	2,597

TABLE 2 - SUMMARY OF ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (ft) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LONG ISLAND SOUND				
Along Westbrook coastline	7.0	9.3	10.7	15.2
MENUNKETESUCK RIVER				
Upstream of Conrail Bridge	5.5	6.2	6.7	15.2

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of the flooding sources studied in detail were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of these flooding sources.

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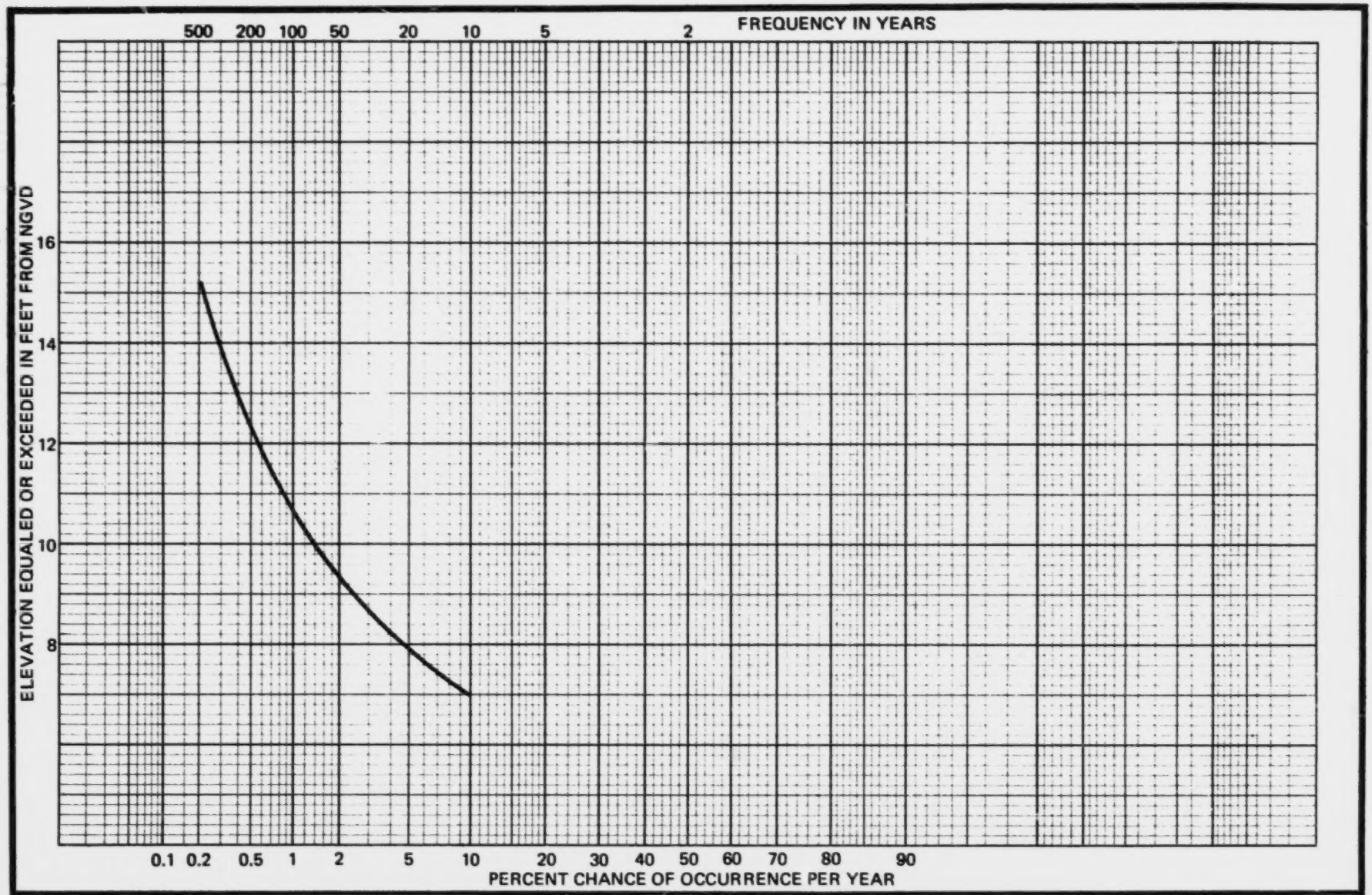
FREQUENCY IN YEARS
500 200 100 50 20 10 5 2
ELEVATION EQUALED OR EXCEEDED IN FEET FROM NGVD
16
14
12
10
8
0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90
PERCENT CHANCE OF OCCURRENCE PER YEAR

FIGURE 7

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

FREQUENCY–TIDE ELEVATION CURVE

LONG ISLAND SOUND

Special flood hazard areas and coastal high hazard zones along the Westbrook coastline were developed from information contained in the COE Interim Memo No. COE 2 and the Flood Insurance Study for the adjacent Town of Old Saybrook (References 5 and 9).

Flood elevations in the Menunketesuck River estuary upstream of the Conrail bridge were determined by a routing analysis using information from the COE Interim Memo No. COE 2 (Reference 5).

Water-surface elevations of floods of the selected recurrence intervals for the Patchogue and Menunketesuck Rivers were computed using the COE HEC-2 computer program (Reference 10). The entire detailed study reach of the Patchogue River is affected by tidal flooding from Long Island Sound. Mean high-water levels in Long Island Sound were used as starting water-surface elevations for the Patchogue and Menunketesuck Rivers (Reference 5).

Cross-section data for streams in the area were obtained by field measurements and aerial photogrammetry. Bridge plans, when available, were utilized to obtain elevation data and structural geometry. All bridges and culverts for which plans were unavailable or out of date were field-surveyed.

Roughness coefficients (Manning's "n") for the streams studied by detailed methods were estimated by field inspection at each cross section. The coefficients for the Patchogue River were 0.025 for the main channel and ranged from 0.050 to 0.100 for the overbank areas. The coefficients for the Menunketesuck River ranged from 0.025 to 0.045 for the main channel and from 0.045 to 0.150 for the overbank areas.

In all areas where analysis indicated that supercritical flow would occur, critical depth was assumed. This is a reasonable assumption given the inherent instability of supercritical flow.

Flood profiles were drawn showing computed water-surface elevations to an accuracy of 0.5 foot for floods of the selected recurrence intervals. Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway is computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 3).

All elevations used in this study are referenced to the National Geodetic Vertical Datum of 1929 (NGVD), formerly referred to as Sea Level Datum of 1929. Locations of the elevation reference marks used in the study are shown on the maps.

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The hydraulic analyses for this study are based on the effects of unobstructed flow. The flood elevations shown on the profiles are valid only if hydraulic structures remain unobstructed and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

A prime purpose of the National Flood Insurance Program is to encourage state and local governments to adopt sound flood plain management programs. Each Flood Insurance Study, therefore, includes a flood boundary map designed to assist communities in developing sound flood plain management measures.

4.1 Flood Boundaries

In order to provide a national standard without regional discrimination, the 100-year flood has been adopted by the FEMA as the base flood for purposes of flood plain management measures. The 500-year flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the boundaries of the 100- and 500-year floods have been delineated using the flood elevations determined at each cross section; between cross sections, the boundaries were interpolated using topographic maps at a scale of 1" = 200' and 1" = 2,000' (enlarged to 1" = 400') with contour intervals of 5 and 10 feet, respectively (References 11 and 12). In cases where the 100- and 500-year flood boundaries are close together, only the 100-year boundary has been shown.

The boundaries of the 100- and 500-year floods are shown on the Flood Boundary and Floodway Map (Exhibit 3). Small areas within the flood boundaries may lie above the flood elevations and, therefore, may not be subject to flooding. Owing to limitations of the map scale and lack of detailed topographic data, such areas are not shown.

Flood boundaries for the approximate study areas were taken from the Flood Hazard Boundary Map (Reference 13).

4.2 Floodways

Encroachment on flood plains, such as artificial fill, reduces the flood-carrying capacity, increases the flood heights of streams, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic

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gain from flood plain development against the resulting increase in flood hazard. For purposes of the Flood Insurance Program, the concept of a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment in order that the 100-year flood can be carried without substantial increases in flood heights. Minimum standards of the FEMA limit such increases in flood heights to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this report are presented to local agencies as minimum standards that can be adopted or that can be used as a basis for additional studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plains. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

Near the mouths of streams studied in detail, floodway computations are made without regard to flood elevations on the receiving water body. Therefore, "With Floodway" elevations presented in Table 3 for certain downstream cross sections of the Patchogue River and the Menunketesuck River are lower than the regulatory flood elevations in that area, which must take into account the 100-year flooding due to backwater from other sources.

As shown on the Flood Boundary and Floodway Map (Exhibit 3), the floodway widths were determined at cross sections; between cross sections, the boundaries were interpolated. In cases where the boundaries of the floodway and the 100-year flood are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and the boundary of the 100-year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 8.

Portions of the floodway widths on the Menunketesuck River are located outside of the corporate limits.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY[2] (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Patchogue River								
A	0.017	80	595	1.8	10.7	2.5	2.5	0.0
B	0.034	67	435	2.5	10.7	2.5	2.5	0.0
C	0.213	80	549	2.0	10.7	2.6	2.6	0.0
D	0.593	60	340	3.2	10.7	2.8	2.8	0.0
E	0.982	70	432	2.5	10.7	3.4	3.4	0.0
F	1.080	100	669	1.6	10.7	3.5	3.5	0.0
G	1.106	60	442	2.5	10.7	4.7	4.7	0.0
H	1.272	50	386	2.8	10.7	4.8	4.8	0.0
I	1.476	60	532	2.1	10.7	4.9	5.0	0.1
J	1.538	110	1,021	1.1	10.7	5.0	5.1	0.1
K	1.566	40	379	2.9	10.7	5.5	5.5	0.0
L	1.663	50	388	2.8	10.7	5.5	5.5	0.0
M	1.704	50	355	3.1	10.7	5.6	5.7	0.1
N	1.810	60	384	2.9	10.7	5.8	5.8	0.0
O	1.916	60	417	2.6	10.7	5.9	6.0	0.1
Menunketesuck River								
A	0.009	233	1,981	1.1	10.7	2.5	2.5	0.0
B	0.149	140	1,245	1.7	10.7	2.5	2.5	0.0

[1] Miles above U. S. Route 1

[2] Elevations computed without consideration of backwater effects from Long Island Sound

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

FLOODWAY DATA

PATCHOGUE RIVER AND MENUNKETESUCK RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FT.)	SECTION AREA (SQ. FT.)	MEAN VELOCITY (F.P.S.)	REGULATORY (NGVD)	WITHOUT FLOODWAY (NGVD)	WITH FLOODWAY (NGVD)	INCREASE (FEET)
Menunketesuck River (continued)								
C	0.419	360	2,475	0.9	10.7	2.6[3]	2.6	0.0
D	0.588	100	922	2.3	10.7	2.6[3]	2.6	0.0
E	0.612	73	437	4.9	6.7	3.2[3]	3.2	0.0
F	0.921	150	1,004	2.1	6.7	4.3[3]	4.3	0.0
G	1.288	60	574	3.6	6.7	5.1[3]	5.4	0.3
H	1.555	70	720	2.9	6.7	5.7[3]	6.5	0.8
I	2.086	175	1,570	1.3	6.7	6.1[3]	7.1	1.0
J	2.123	90[2]	1,253	1.5	11.8	11.8	11.8	0.0
K	2.287	110[2]	1,500	1.3	11.9	11.9	11.9	0.0
L	2.427	150[2]	2,041	1.0	11.9	11.9	11.9	0.0
M	2.840	160[2]	1,862	1.0	13.6	13.6	13.6	0.0
N	3.287	245[2]	2,223	0.9	13.7	13.7	13.7	0.0
O	3.603	35[2]	300	6.5	14.6	14.6	14.9	0.3
P	3.718	90[2]	413	4.7	16.1	16.1	16.7	0.6
Q	3.748	80[2]	613	3.2	18.7	18.7	18.8	0.1

[1]Miles above U. S. Route 1
[2]This width extends beyond corporate limits
[3]Elevation computed without consideration of backwater effects from Long Island Sound

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

FLOODWAY DATA

MENUNKETESUCK RIVER

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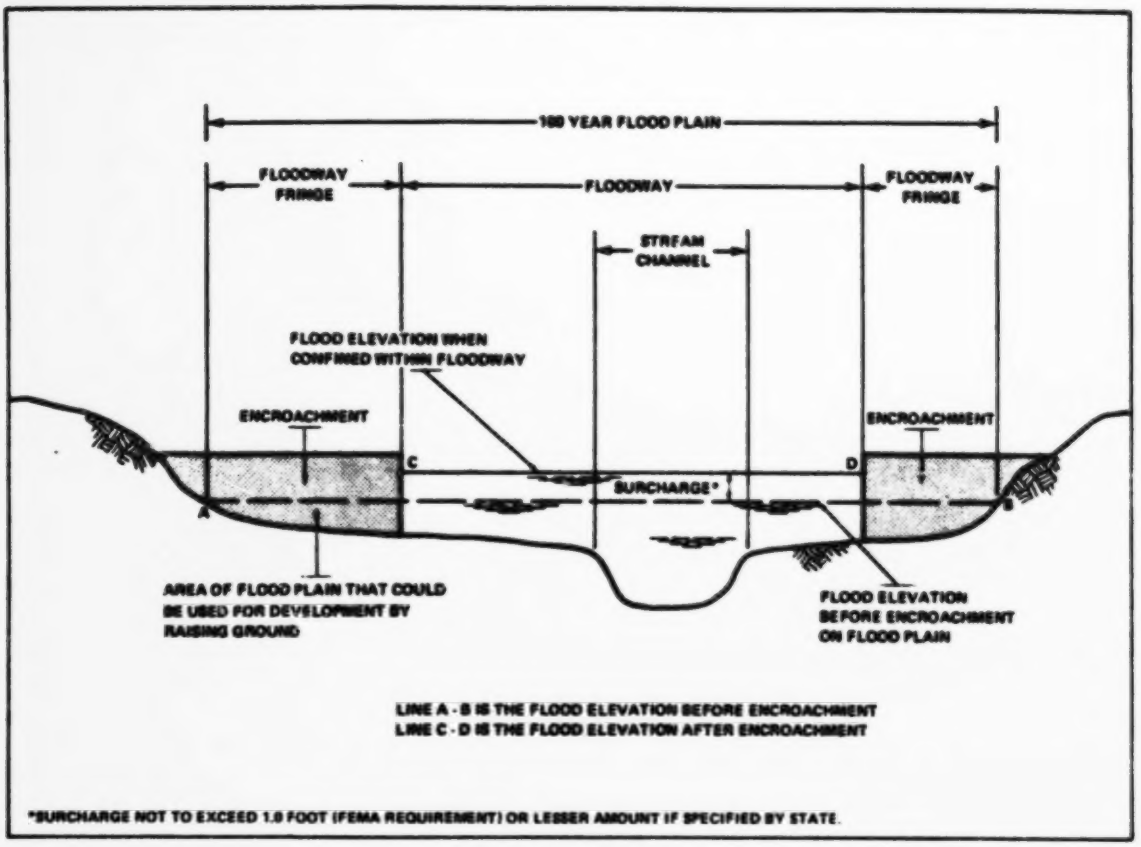
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 8

5.0 INSURANCE APPLICATION

In order to establish actuarial insurance rates, the FEMA has developed a process to transform the data from the engineering study into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors (FHFs), and flood insurance zone designations for each flooding source affecting the Town of Westbrook.

5.1 Reach Determinations

Reaches are defined as lengths of watercourses having relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. For riverine flooding, this difference does not have a variation greater than that indicated in the following table for more than 20 percent of the reach. In tidal areas, reaches are limited to the distance for which the difference between 10- and 100-year flood does not vary more than 1.0 foot. Using this criterion the Long Island Sound, the Patchogue River, and the lower portions of the Menunketesuck River qualify as one reach. The portion of the Menunketesuck River between the Conrail bridge and State Route 145 qualifies as another reach. Locations of these reaches are shown on the Flood Insurance Rate Map.

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Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Town of Westbrook are shown on the Flood Profiles (Exhibit 1) and are summarized in the Flood Insurance Zone Data Table (Table 4).

5.2 Flood Hazard Factors

The FHF is the FEMA device used to correlate flood information with insurance rate tables. Correlations between property damage from floods and their FHFs are used to set actuarial insurance premium rate tables based on FHFs from 005 to 200.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations expressed to the nearest 0.5 foot, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year water-surface elevations is greater than 10.0 feet, accuracy for the FHF is to the nearest foot.

5.3 Flood Insurance Zones

After the determination of reaches and their respective FHFs, the entire incorporated area of Westbrook was divided into zones, each having a specific flood potential or hazard. Each zone was assigned one of the following flood insurance zone designations:

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

Zones A2, A4, A7: Special Flood Hazard Areas inundated by the 100-year flood, determined by detailed methods; base flood elevations shown, and zones subdivided according to FHF.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Long Island Sound							
Reach 1	02,05,06	-3.7	-1.3	+4.5	035	A7,V7	11
Tidal flooding affecting Menunketesuck River from Conrail bridge to State Route 145	05	-1.2	-0.5	+8.5	010	A2	7
Menunketesuck River							
Reach 1	05	-2.0	-0.4	+0.8	020	A4	Varies
Reach 2	03	-1.1	-0.2	+1.4	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

FLOOD INSURANCE ZONE DATA

LONG ISLAND SOUND AND MENUNKETESUCK RIVER

Zone V7: Special Flood Hazard Areas along coasts inundated by the 100-year flood as determined by detailed methods, and that have additional hazards due to velocity (wave action); base flood elevations shown, and zones subdivided according to FHFs.

Zone B: Areas between the Special Flood Hazard Area and the limits of the 500-year flood, including areas of the 500-year flood plain that are protected from the 100-year flood by dike, levee, or other water control structure; also, areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flooding.

Table 4, "Flood Insurance Zone Data," summarizes the flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the Town of Westbrook.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Westbrook is, for insurance purposes, the principal result of the Flood Insurance Study. This map (published separately) contains the official delineation of flood insurance zones and base flood elevation lines. Base flood elevation lines show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. This map is developed in accordance with the latest flood insurance map preparation guidelines published by the FEMA.

6.0 OTHER STUDIES

Contacts with local, state, and Federal agencies were made, and a thorough literature search was conducted to determine the availability of existing studies and data relative to discharge analysis and flood elevations in the Town of Westbrook, Connecticut.

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Published data available in the Flood Insurance Study for the adjacent community of Old Saybrook, Connecticut, along with published data available in Interim Memo No. COE 2 were reviewed and used as necessary to complete the hydrologic and hydraulic analyses of all the watercourses studied, including the Westbrook coastline (References 9 and 5).

This study is authoritative for purposes of the Flood Insurance Program, and the data presented here either supersede or are compatible with previous determinations.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natual and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region I Office, J. W. McCormack Post Office and Courthouse Building, Room 462, Boston, Massachusetts 02109.

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TIDAL FLOODING FROM LONG ISLAND SOUND
ZONE A7

BOSTON POST ROAD (US ROUTE 1)

WESLEY AVENUE

ELEVATION IN FEET (NGVD)

20
10
0
-10

0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

STREAM DISTANCE IN MILES ABOVE US ROUTE 1

A B C D E F G H

LEGEND

- 500 YEAR FLOOD
- 100 YEAR FLOOD
- 50 YEAR FLOOD
- 10 YEAR FLOOD
- STREAM BED
- CROSS SECTION LOCATION

FLOOD PROFILES

PATCHOGUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

01P

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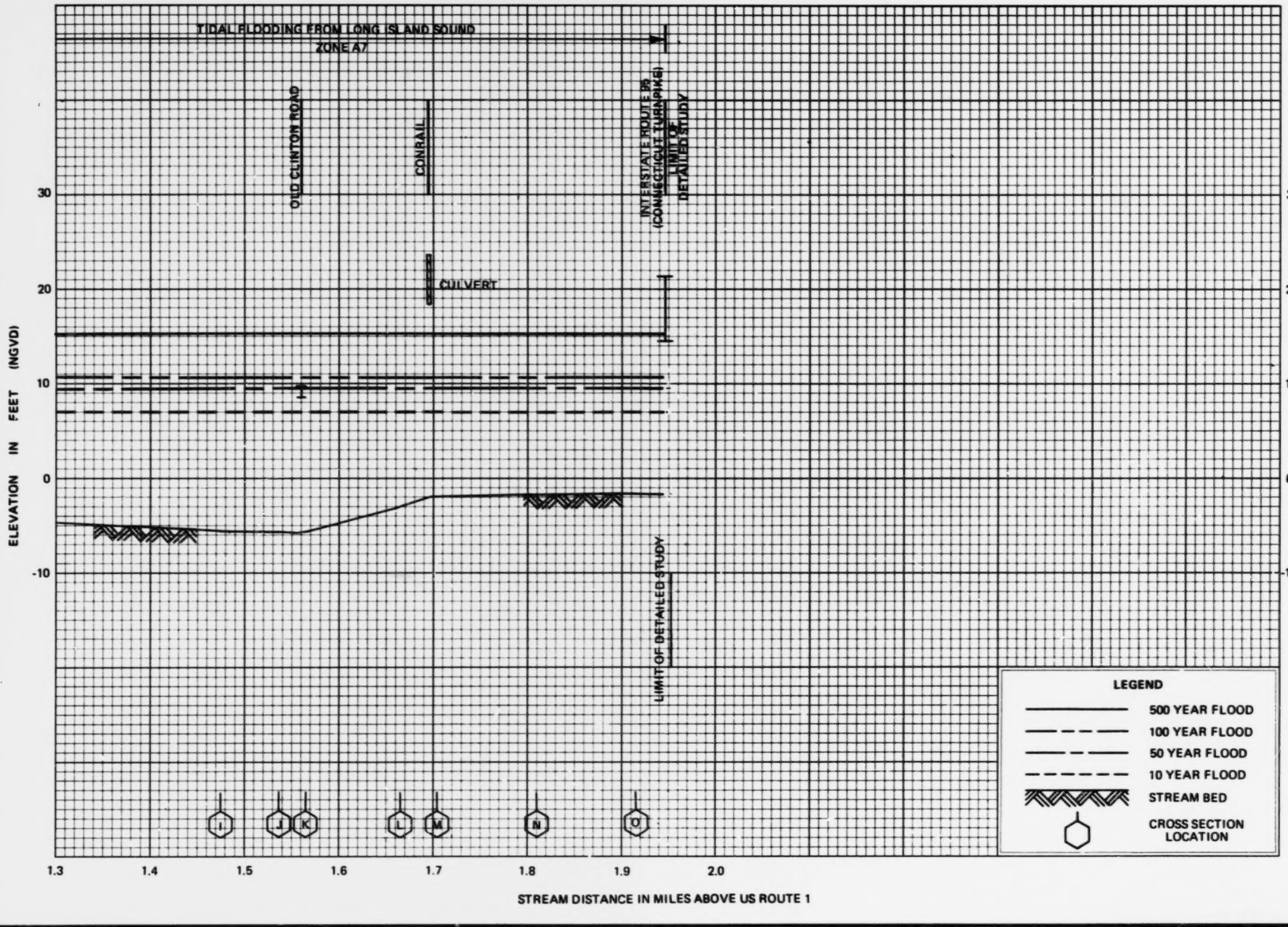

FLOOD PROFILES

PATCHOGUE RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

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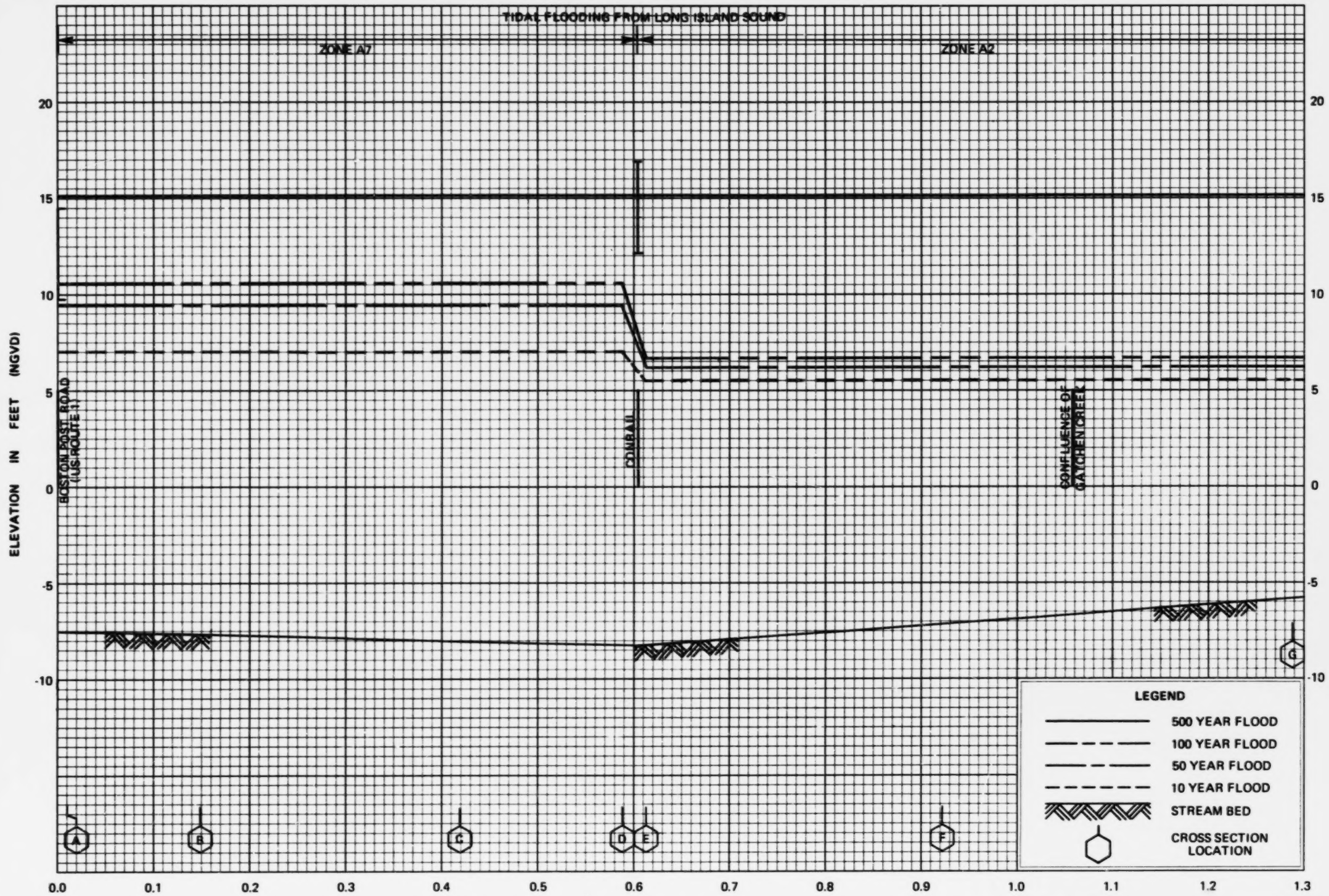

FLOOD PROFILES

MENUNKETESUCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

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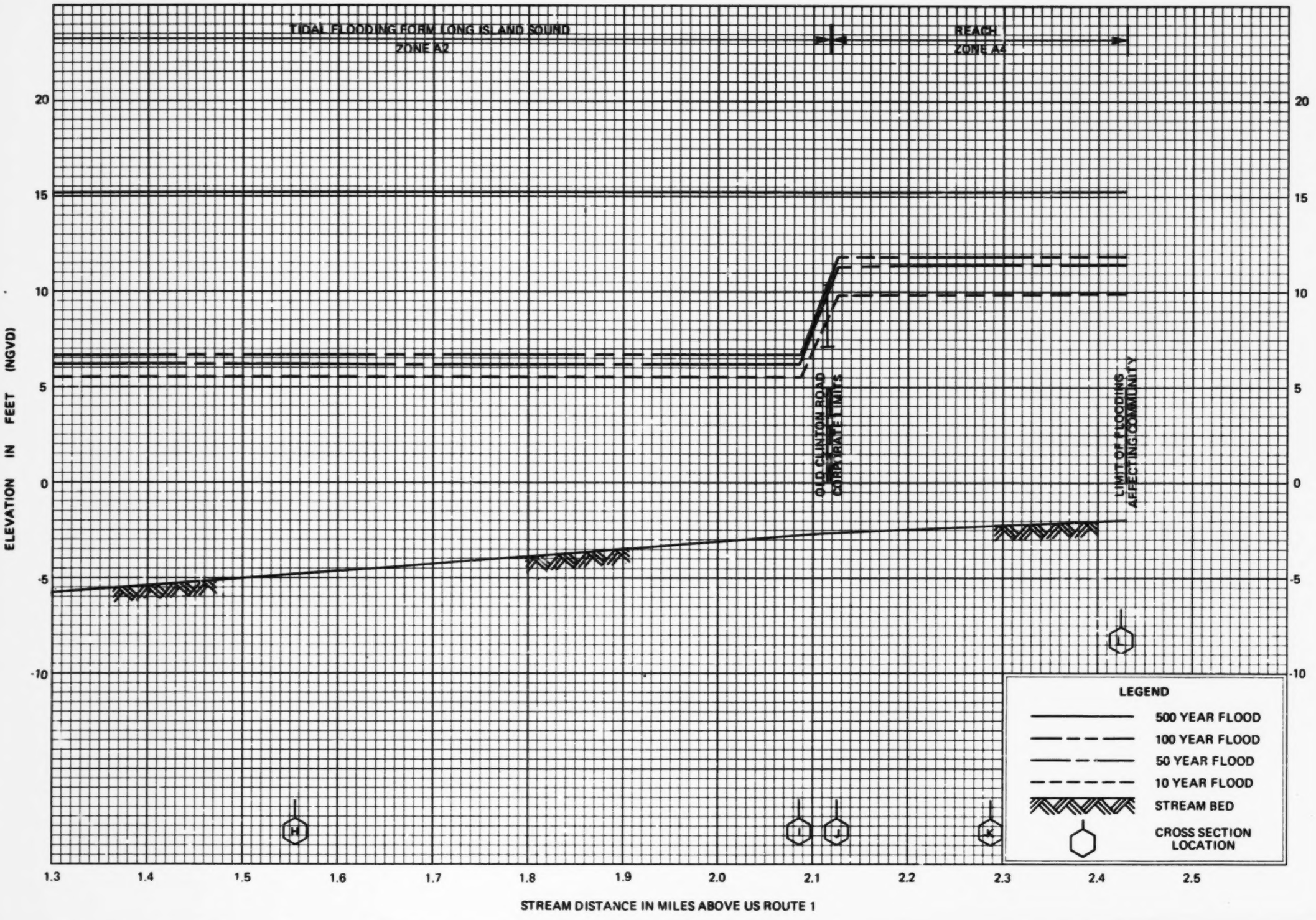

FLOOD PROFILES

MENUNKETESUCK RIVER

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

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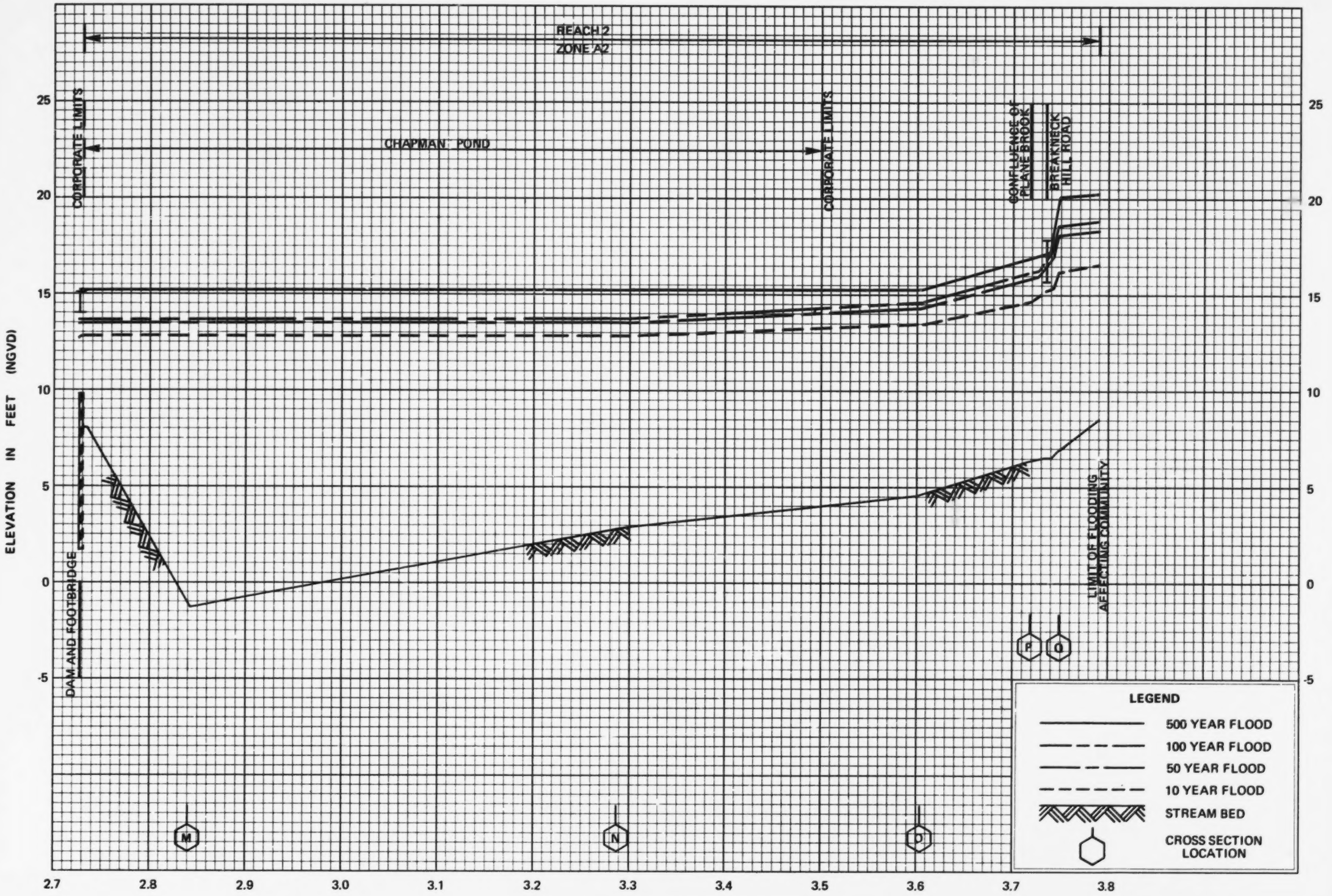

FLOOD PROFILES

MENUNKETESUCK RIVER

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TOWN OF WESTBROOK, CT
(MIDDLESEX CO.)

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